AMERICAN MUSEUM
Novitates

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, NY 10024
Number 3558, 17 pp., 9 figures March 8, 2007

A New Genus and New Species of Austro-Papuan Orthotylinae (Heteroptera: Miridae)

MICHAEL A. WALL[1]

ABSTRACT

Sagittacopula, new genus, is described to accommodate *S. rufescens*, new species, from Cape York Peninsula, and *S. carvalhoi*, new species, from eastern New Guinea. *Morobea* Carvalho and its type species, *Morobea longipes* Carvalho, are redescribed, and *M. spectabilis*, new species, from eastern New Guinea is described. *Wumea* Carvalho and its type species, *Wumea cylpealis* Carvalho, are redescribed, and *W. cassisi*, new species, from eastern New Guinea is described.

INTRODUCTION

Many species of Orthotylinae of New Guinea and the surrounding region share a shining glassy body, an anteroventrally projecting head, with a distinctly carinate posterior margin, a flat pronotal collar, and gracile appendages. This morphology is epitomized by *Morobea* Carvalho (1987), *Candidomiris* Kerzhner and Schuh (1995), *Wumea* Carvalho (1987), *Dimifacoris* Carvalho (1987), and a suite of undescribed taxa, which I collectively refer to as the *Candidomiris*-group. Within the *Candidomiris*-group are several species that are diagnosed by an elongate parallel-sided body, a projecting clypeus, a strongly carinate posterior margin of the head capsule that projects over the anterior margin of the pronotum, a broadly emarginate posterior margin of the pronotum, and relatively long metathoracic legs. In the present paper, I redescribe two genera and species originally described by Carvalho (1987) and describe one new genus and four new species that fall within this subset of the *Candidomiris*-group.

All measurements are in millimeters. Abbreviations for measurements are as follows: L-Tot = total length, Cly-Cun = length from clypeus to cuneal fracture, L-Hd = length of head, L-Prn = length of pronotum, L-Sct = length of scutellum, L-Cun = length of cuneus, W-Hd = width of head, W-Prn = width of pronotum, W-Sct = width of scutellum, IOD = interocular distance, L-AI = length of antennal segment I, L-AII =

[1]Department of Entomology, San Diego Natural History Museum, San Diego, CA 92112. (mwall@sdnhm.org).

Copyright © American Museum of Natural History 2007 ISSN 0003-0082

SHOUT
SHARE
IT

length of antennal segment II, L-AIII = length of antennal segment III, L-AIV = length of antennal segment IV, L-mtf = length of metafemora, and L-mtt = length of metatibiae.

Morobea Carvalho

Morobea Carvalho, 1987: 181.

TYPE SPECIES: *Morobea longipes* Carvalho, 1987 (original designation).

DIAGNOSIS: Recognized among other Orthotylini by the following combination of characters: elongate parallel-sided body (fig. 1a, b, d); projecting clypeus (fig. 2c); strongly carinate posterior margin of head projecting over anterior margin of pronotum (fig. 2a, c); disc of pronotum coarsely rugulose (fig. 2a); posterior margin of pronotum broadly emarginate; metathoracic legs relatively long. Males with second antennal segment with species specific arrangement of short setae at base (fig. 3); genital capsule enormous (fig. 4a, 5a), subequal to one-half abdominal length; opening of genital capsule disproportionately large, clearly exposing complex aedeagus; aedeagus with remarkably convoluted and heavily sclerotized phallotheca (figs. 4d, 5e); ductus seminis with thickened heavily sclerotized ring proximal to secondary gonopore.

REDESCRIPTION: Male: *General Aspect*: Macropterous, elongate, parallel-sided, total length 5.88–6.57; length from apex to clypeus to cuneal fracture 4.42–4.75; width across humeral angles of pronotum 0.83–0.96. *Coloration and Vestiture* (figs. 1a, d): Body yellowish brown with red and green maculations; antennae and legs yellowish brown with red maculation on apices of metafemora; membrane of forewing moderately suffused with brown; veins red to undifferentiated. Dorsum with sparse fine, short, hyaline setae; mesepisternum and metepisternum with field of dense microchaetae; legs and antennae with fine, distally orientated short, red, setae. *Structure*: Head (fig. 2a–c) moderately projecting in front of eyes; posterior margin convex; posterior margin strongly carinate, projecting over anterior margin of pronotum; frons flat posteriorly becoming steeply declivent anteriorly; clypeus distinctly projecting in front of frons; gena and maxillary plates extending anteroventrally; buccal cavity obovate, short; eyes occupying about one-half of total head height in lateral view, posterolateral margin slightly separated from margin of pronotum; antennae inserted midway between ventral and dorsal margins of eye. Antennae elongate, gracile; segment I subequal to length of pronotum, vasiform; segment II cylindrical, elongate with species specific arrangement of short setae at base (fig. 3), three times longer than segment I; segment III and IV gracile, often coiled in dry specimens. Labium reaching just beyond posterior margin of metacoxae. Pronotum elongate trapeziform, slightly longer than broad, coarsely punctate posteriorly; pronotal collar thin, slightly overlapped dorsally by weakly carinate margin of disc; lateral margins slightly emarginate; posterior margin distinctly sinuate with medial emargination; disc weakly convex, vaguely separated into anterior and posterior lobes by shallow sulcus; calli weakly raised, undifferentiated. Mesoscutum weakly exposed. Scutellum triangular, slightly convex. Hemelytra elongate, parallel-sided to posterior margin of cuneus; cuneus two to three times longer than broad. Metathoracic spiracle large with evaporative areas (fig. 2e); ostiole lenticular, placed anteriorly on metepisternum; peritreme swollen anteriorly and posteriorly (fig. 2f); evaporative area extending to posterior margin of metepisternum, deflexed posteriorly. Legs extremely elongate; claws moderately curved with apically convergent parempodia (fig. 2d). *Genitalia* (figs. 4–5): Genital capsule large; genital opening disproportionately large; ventral margin of aperture with dorsal and ventral projections. Left paramere elongate, bent near base with a sinuous apical process. Right paramere relatively short, robust, bent at midlength. Phallotheca complex, highly dissected, projecting well outside of genital capsule. Aedeagus relatively simple; ductus seminis with heavily sclerotized ring basal to secondary gonopore; secondary gonopore weakly defined.

FEMALE: Ovipositor approximately one-half length of abdomen; subgenital plate narrowly triangular with acute distal margin, roughly one-third length of ovipositor.

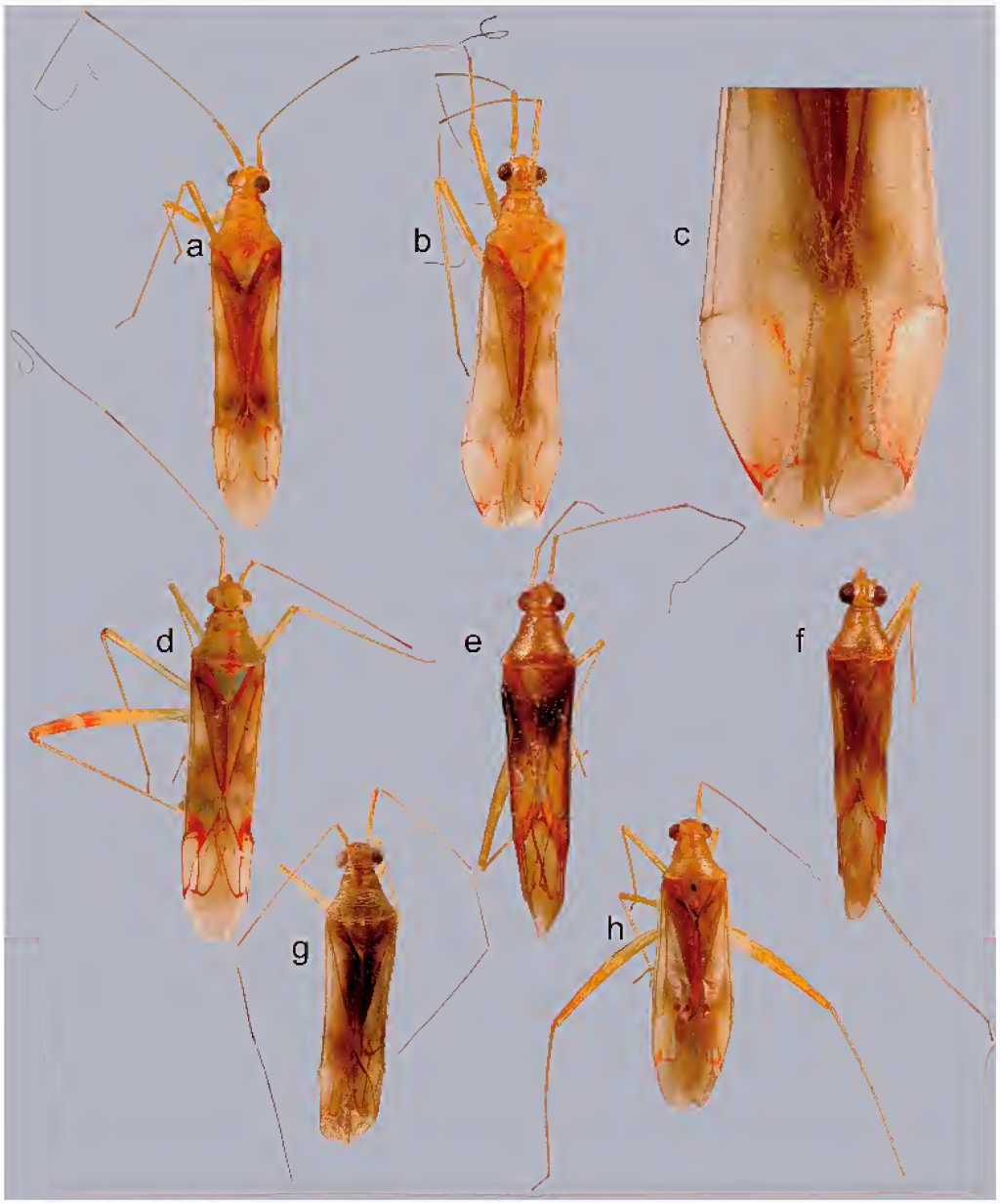

Fig. 1. Dorsal habitus photographs. **a.** *Morobea longipes* (male). **b.** *M. longipes* (female). **c.** close-up of cuneus of *M. longipes* (female). **d.** *M. spectabilis*. **e.** *Wumea cassisi*. **f.** *W. cylpealis*. **g.** *Sagittacopula carvalhoi*. **h.** *S. rufescens*.

Morobea longipes Carvalho
figures 1a–c, 2, 3a, 4

Morobea longipes Carvalho 1987: 181 (n.sp.).

DIAGNOSIS: Differentiated from similar taxa by characters listed in generic diagnosis and discontinuous red maculations along dorsal margin of propleuron, most prominent anteriorly; genital capsule without lateral tubercle; aedeagus with relatively small, serrated, hatchetlike lobal sclerite (fig. 4d–e). Females with long medially oriented setae on posterior margin of corium (fig. 1c).

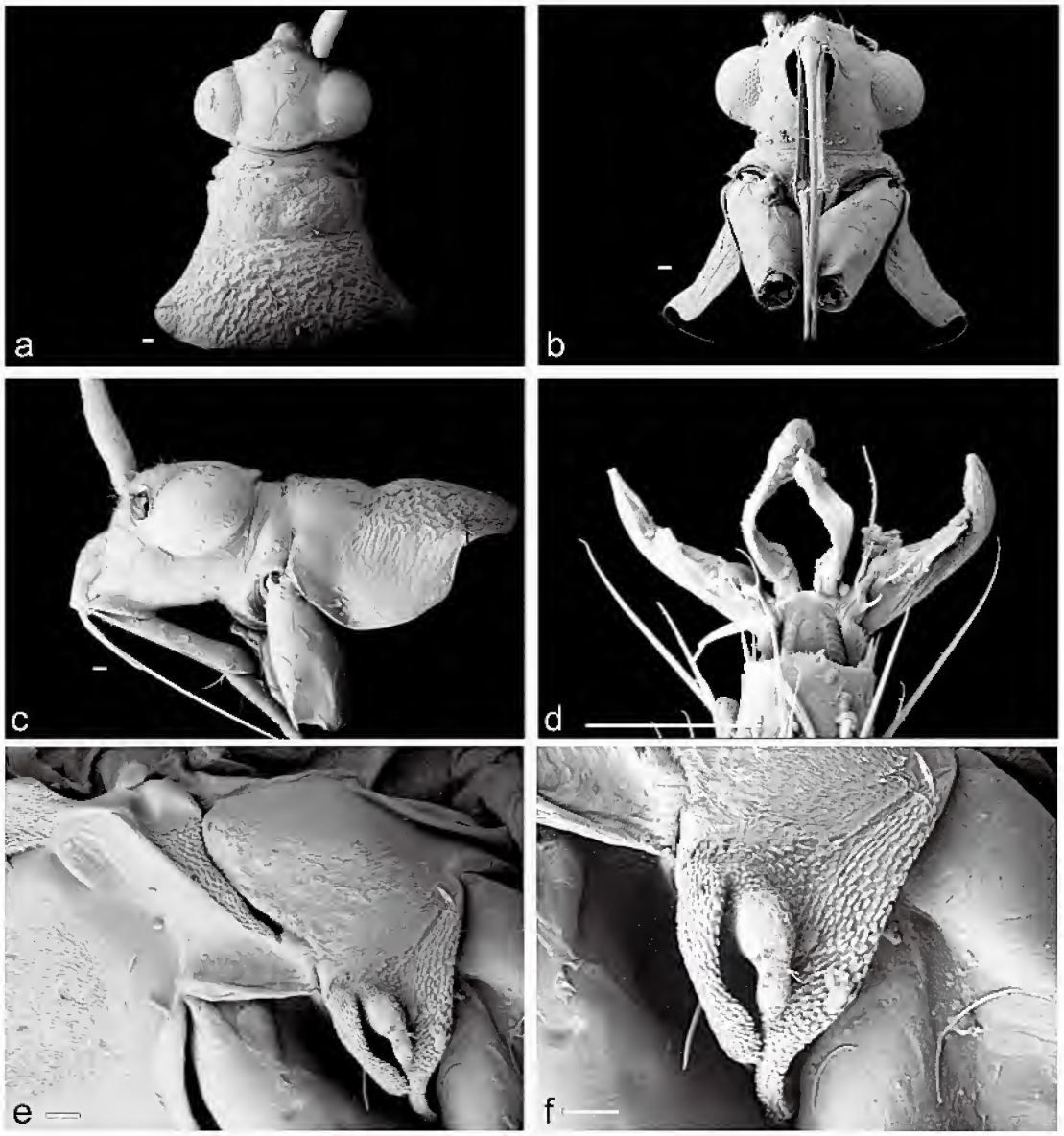

Fig. 2. Scanning electron micrographs of *Morobea longipes*. **a.** Head and pronotum, dorsal view. **b.** Head and pronotum, ventral view. **c.** Head and pronotum, lateral view. **d.** Pretarsus, ventral view. **e.** Meso- and metathorax, lateral view. **f.** Evaporative area (scale bars = 50 μm).

REDESCRIPTION: *Coloration* (fig. 1a): Head yellowish brown with vague red maculations on clypeus and mandibular plates. Antennae yellowish brown becoming darker distally. Prothorax yellowish brown, tinged with green in some specimens; disc and collar undifferentiated; dorsal margin of propleuron with red maculation at anterolateral margin, undifferentiated ventrally. Scutellum yellowish brown, sometimes suffused with blue-green. Hemelytra predominately yellowish brown; margin of clavus weakly suffused with red along scutellar margin; cuneus ringed with red. Abdomen yellow with dorsal surface of male genital capsule dark brown. Legs predominately yellow, becoming brown distally,

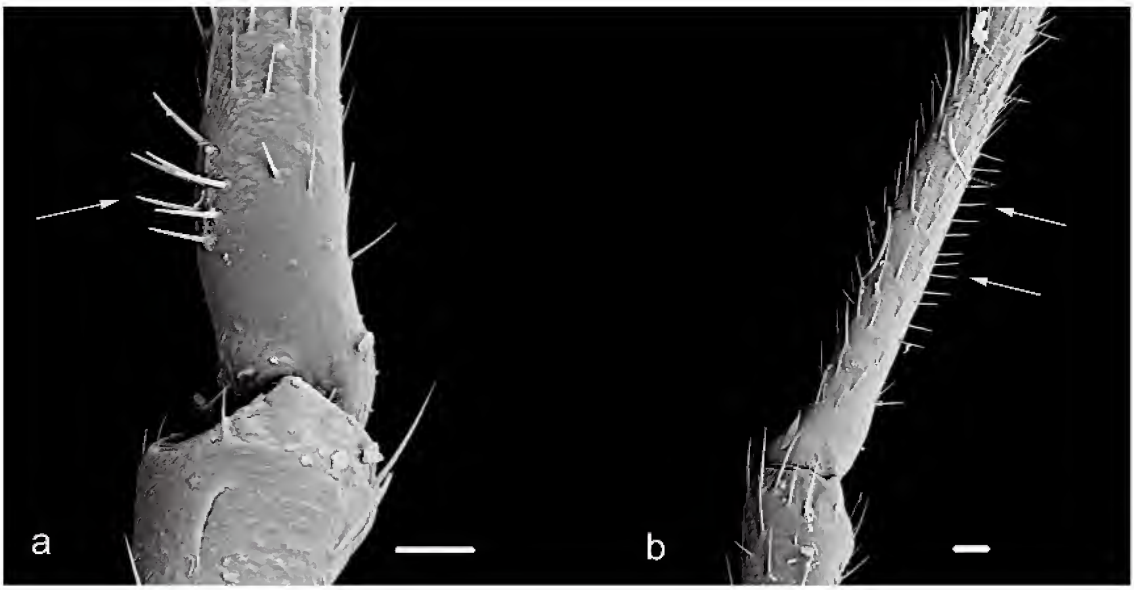

Fig. 3. Scanning electron micrographs of the base of second antennal segment in *Morobea*. **a.** *M. longipes*. **b.** *M. spectabilis* (scale bars = 30 μm).

ventral surface suffused with blue-green; metafemur with pale brown spots on anterior surface and red distally. *Structure*: As in generic description with the following additions. Head with weak sulcus along length of vertex and frons; antennal segment II weakly swollen as base, swollen portion with dense field of short hairs oriented perpendicular to antennal surface (fig. 3a). Cuneus 2.5 times longer than broad, subtriangular. Small cell of hemelytral membrane less than one-third length of cuneus. *Genitalia* (fig. 4): Genital capsule broadly subconical with large aperture; dorsal projection of ventral rim roughly symmetrical, slightly skewed to left, broadly rounded; ventral projection of ventral rim asymmetrical skewed left, acute. Parameres as in generic description; right paramere with small apical lobe. Theca sclerotized basally, distally convoluted into several large flanges and hooks; apical serrate process relatively small and hatchetlike. Aedeagus as in generic description.

Female (fig. 1b): Similar to males except antennal segment II simple; cuneus 1.5 times longer than broad, subrectangular; posterior margin of corium with large medially oriented setae, hairs longer than width of large cell (fig. 1c); small cell of hemelytral membrane minute, almost obsolete; medial portion of membrane with large field of short velutinous hairs. *Genitalia*: Ovipositor as in generic description. Internal genitalia unknown due to damaged material.

Measurements: Males (N = 2): L-Tot 5.88–6.11, Cly-Cun 4.42–4.44, L-Hd 0.59–0.62, L-Prn 0.83–0.93, L-Sct 0.59–0.62, L-Cun 0.92–1.03, W-Hd 0.57–0.79, W-Prn 1.18–1.21, W-Sct 0.57–0.61, IOD 0.35–0.37, L-AI 0.86–1.01, L-AII 2.88–3.19, L-AIII 1.67–1.67, L-AIV 2.11, L-mtf 3.55, L-mtt 5.87. Females (N = 2): L-Tot 6.06, Cly-Cun 4.73, L-Hd 0.62, L-Prn 0.83–0.90, L-Sct 0.55–0.65, L-Cun 1.05–1.13, W-Hd 0.79, W-Prn 1.17–1.29, W-Sct 0.61–0.64, IOD 0.41, L-AI 1.02, L-AII 3.18, L-AIII 1.72, L-AIV 1.65, L-mtf 3.30, L-mtt 5.61.

Hosts: Collected from *Pipturus* sp. (Urticaceae).

Distribution: Eastern New Guinea.

Specimens Examined: **PAPUA NEW GUINEA: Morobe:** Wau, 7.3333°S 146.71667°E, 1100 m, 16 Aug 1972, G. G. E. Scudder, 1♀ (AMNH_PBI 00053260) (BPBM); 12 Aug 1977, W. C. Gagne, 1♀ (AMNH_PBI 00053259) (BPBM); 20 Jul 1974, A.D. Hart, *Pipturus* sp. (Urticaceae), 1♀(AMNH_PBI 00053258) (BPBM); 21 Apr 1979, W. C. Gagne, 1♂ (AMNH_PBI 00053261) (BPBM).

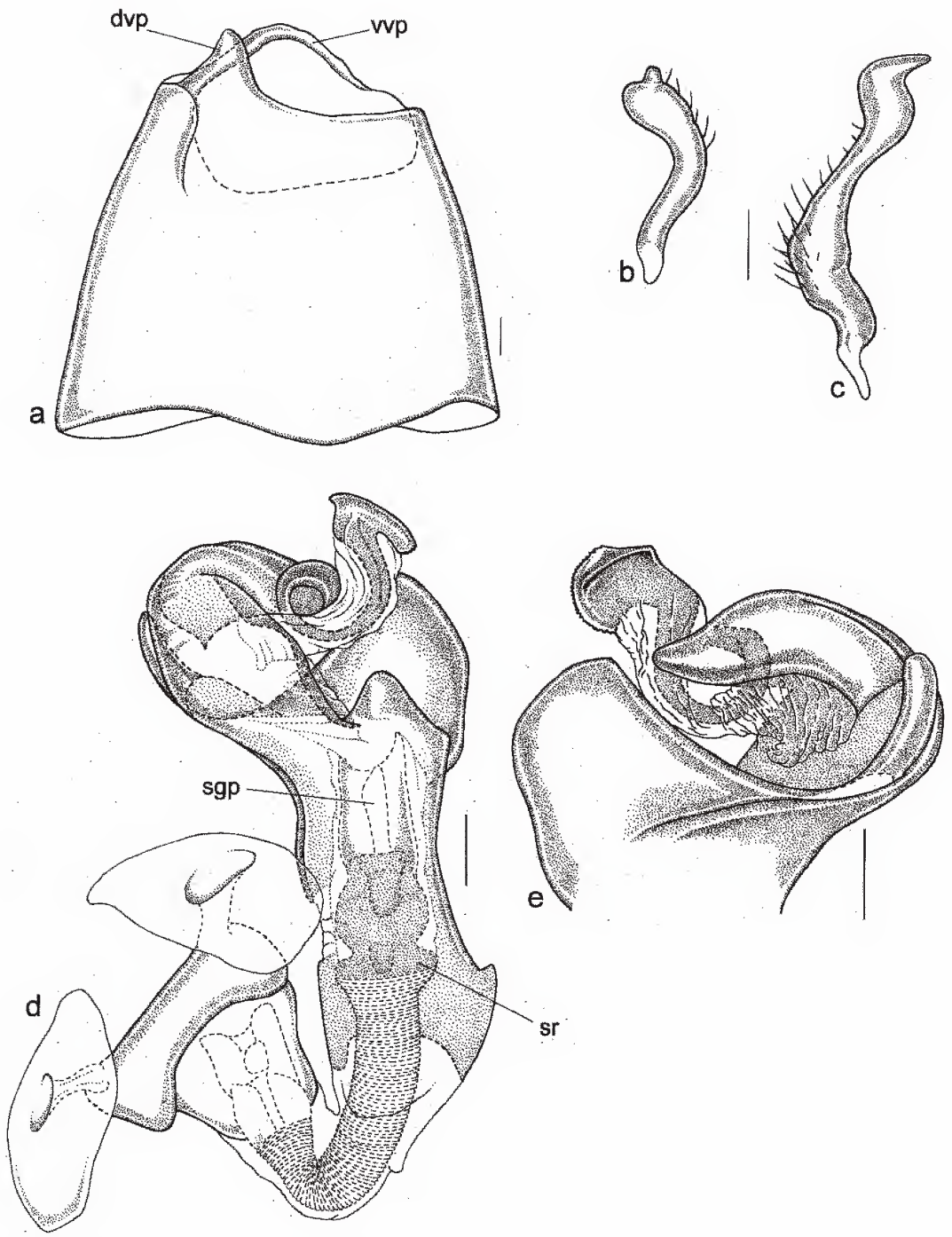

Fig. 4. Male genitalia of *Morobea longipes*. **a.** Genital capsule, ventral view. **b.** Right paramere, ventral view. **c.** Left paramere, ventral view. **d.** Aedeagus, left lateral view. **e.** Distal portion of aedeagus, right lateral view (**dvp** dorsal projection of ventral margin; **sgp** secondary gonopore; **sr** sclerotized ring; **vvp** ventral projection of ventral margin; scale bars = 0.1 mm).

Morobea spectabilis, new species
figures 1d, 3b, 5

HOLOTYPE: **PAPUA NEW GUINEA: Morobe:** Wau, 7.3333°S 146.71667°E, 1100 m, 14 Aug 1972, G. G. E. Scudder, Light Trap, 1♂ (AMNH_PBI 00053250) (BPBM).

DIAGNOSIS: Differentiated from similar taxa by characters listed in generic diagnosis and contiguous red line along dorsal margin of propleuron; genital capsule with lateral tubercle; aedeagus with relatively large, serrated, hatchetlike lobal sclerite (fig. 5e). Females with short setae on posterior margin of corium.

DESCRIPTION: *Coloration* (fig. 1d): Head yellowish brown with red maculations on clypeus and mandibular plates; gula suffused with blue-green. Antennae yellowish brown becoming darker distally. Prothorax yellowish brown, tinged with green; disc with dorsal red medial stripe; collar red; dorsal margin of propleuron with red stripe along length, suffused with blue ventrally. Scutellum blue-green with medial triangular red maculation on anterior margin. Hemelytra predominately yellowish brown with red maculation along anterior cuneal margin; margin of clavus suffused with red along commissure and scutellar margin; cuneus narrowly margined with red. Abdomen yellow with dorsal surface of male genital capsule dark brown. Legs predominately yellow becoming brown distally, ventral surface suffused with blue-green; metafemur with pale brown spots on anterior surface and red distally. *Structure*: As in generic description with the following additions. Head with relatively deep distinct sulcus along length of vertex and frons; basal fourth of antennal segment II with series of 12–17 short hairs oriented perpendicular to antennal surface (fig. 3b). Small cell of hemelytral membrane greater than one-half length of cuneus. *Genitalia* (fig. 5): Genital capsule roughly cylindrical with large opening and large tubercle on left lateral surface; ventral projection of ventral margin asymmetrical to right side, subquadrate; dorsal projection of ventral margin asymmetrical to right side, auriculate with sharp stout process on left margin. Parameres as in generic description. Theca sclerotized basally, distally convoluted into several large flanges. Aedeagus with large hooked and elongate, serrated, hatchet-shaped lobal sclerites.

FEMALES: Similar to males. Basal portion of antennal segment II undifferentiated from remainder. *Genitalia*: Ovipositor as in generic description. Vestibulum convoluted with complex paired in-foldings; sclerotized rings large, weakly sclerotized, laterally folded for entire length, more than twice as long as broad, aperture irregular; dorsal labiate plate convoluted medially with lateral weakly sclerotized in-foldings; posterior wall with paired interramal sclerites; interramal lobes (K-structures of Slater 1950) one-fifth the length of the ovipoister, semicircular, distinctly spinulose.

MEASURMENTS: Males (N = 2): L-Tot 6.12–6.57, Cly-Cun 4.42–4.75, L-Hd 0.52–0.55, L-Prn 0.92–0.96, L-Sct 0.64–0.71, L-Cun 1.03–1.10, W-Hd 0.81–0.87, W-Prn 1.33–1.38, W-Sct 0.65–0.69, IOD 0.37–0.45, L-AI 0.99–1.01, L-AII 3.21–3.30, L-AIII 1.69–1.77, L-AIV 2.09–2.09, L-mtf 3.20–3.47, L-mtt 5.78–6.07. Female (N = 1):, L-Tot 6.61, Cly-Cun 4.81, L-Hd 0.56, L-Prn 0.95, L-Sct 0.66, L-Cun 1.13, W-Hd 0.84, W-Prn 1.34, W-Sct 0.6579–0.6579, IOD 0.41, L-AI 1.06, L-AII 3.41, L-mtf 3.45, L-mtt 5.63.

ETYMOLOGY: Named for the spectacular male genitalia and relatively bright coloration of this species.

HOSTS: No known hosts, collected at light traps.

DISTRIBUTION: Eastern New Guinea.

PARATYPES: **PAPUA NEW GUINEA: Morobe:** Wau, 7.3333°S 146.71667°E, 1100 m, 9 Aug 1972, G. G. E. Scudder, Light Trap, 1♀/ (AMNH_PBI 00053252) (BPBM); 11 Sep 1972, G.G.E. Scudder, Light Trap, 1♂ (AMNH_PBI 00053251) (BPBM).

Wumea Carvalho

Wumea Carvalho, 1987: 186.

TYPE SPECIES: *Wumea clypealis* Carvalho, 1987 (original designation).

DIAGNOSIS: Recognized among other Orthotylini by the following combination of characters: elongate parallel-sided body (fig. 1e, f); projecting clypeus; strongly carinate posterior margin of head projecting over anterior margin of pronotum; disc of pronotum shining with weak rugullae; posterior

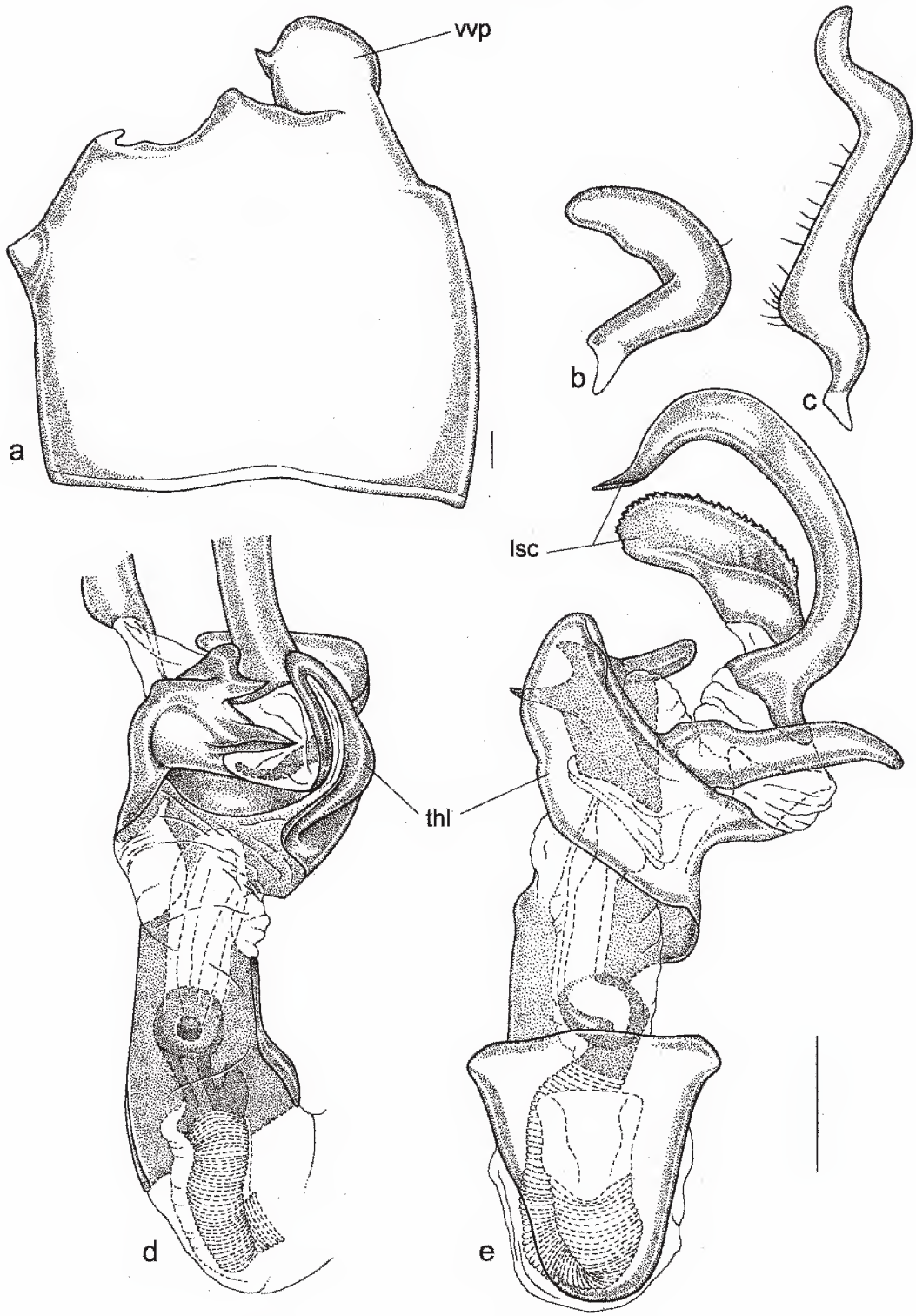

Fig. 5. Male genitalia of *Morobea spectabilis*. **a.** Genital capsule, ventral view. **b.** Right paramere, ventral view. **c.** Left paramere, ventral view. **d.** Portion of aedeagus, left lateral view. **e.** Aedeagus, ventral view (**lsc** lobal sclerite; **thl** thecal lobe; **vvp** ventral projection of ventral margin; scale bars = 0.1 mm).

margin of pronotum broadly emarginated; and relatively long metathoracic legs. Distinguished from similar genera by gently sloping frons and branched left paramere in males (figs. 6c, 7c).

REDESCRIPTION: Male: *General Aspect*: Macropterous, elongate, parallel-sided, total length 4.66–5.40; length from apex to clypeus to cuneal fracture 3.40–3.89; width across humeral angles of pronotum 1.01–1.13. *Coloration and vestiture* (fig. 1e, f): Dorsally reddish brown; ventrally darker; antennae and legs yellowish brown with red maculation on apices of metafemora; membrane of forewing moderately suffused with brown; veins reddish brown. Dorsum essentially glabrous; metepisternum with field of dense microchaetae; few hyaline, short setae present on dorsum; legs and antennae with fine, short, hyaline setae. *Structure*: Head moderately projecting in front of eyes; posterior margin convex; posterior margin strongly carinate, projecting over anterior margin of pronotum; frons flat posteriorly becoming gently declivent anteriorly; clypeus distinctly projecting in front of frons; gena and maxillary plates extending anteriorly; buccal cavity obovate, posterior margin well separated from anterior margin of prosternum; eyes occupying almost all of total head height in lateral view, posterolateral margin slightly separated from margin of pronotum; antennae inserted just below dorsal margin of eye. Antennae elongate, gracile; segment I subequal to length of pronotum, vasiform; segment II cylindrical, elongate, three times longer than segment I; segment III and IV gracile, often corkscrewed in dry specimens. Labium reaching metacoxae. Pronotum elongate, trapeziform, slightly longer than broad, weakly rugose; pronotal collar, thin, shallowly emarginate dorsally; lateral margins slightly emarginate; posterior margin distinctly sinuate with medial emargination; disc weakly convex, vaguely separated into anterior and posterior lobes by shallow sulcus; calli obsolete, undifferentiated. Mesoscutum not exposed. Scutellum triangular, slightly convex. Hemelytra elongate, parallel-sided to posterior margin of cuneus; cuneus two to three times longer than broad; vein of large cell with short spur vein along posterior border. Metathoracic spiracle large with evaporative areas; ostiole lenticular, placed anteriorly on metepisternum; peritreme swollen, evaporative area extending to posterior margin of metepisternum, relatively flat posteriorly. Legs extremely elongate; claws moderately curved with apically convergent parempodia. *Genitalia* (figs. 6, 7): Genital capsule large, subconical; ventral projection acute to broadly rounded. Left paramere divided into two main branches, sometimes with tubercles. Right paramere variable. Phallotheca relatively simple, slightly sclerotized, sometimes with distal angular projection. Aedeagus relatively simple; ductus seminis with heavily sclerotized swollen area prior to secondary gonopore; secondary gonopore elongate, elliptical, surrounded by papillate membrane.

FEMALE: Similar to males. Ovipositor approximately one-third length of abdomen; subgenital plate narrowly triangular with acute distal margin, roughly one-third length of ovipositor.

Wumea cassisi, new species
figures 1e, 6

HOLOTYPE: **PAPUA NEW GUINEA: Morobe:** Huon Peninsula, Moigisung, 6.4167°S 147.5°E, 500 m, 13 Sep 1976, W. C. Gagne, Light Trap, 1♂ (AMNH_PBI 00053257) (BPBM).

DIAGNOSIS: Differentiated from similar taxa by characters listed in generic diagnosis and genital capsule with acute ventral projection (fig. 6a); weakly branched right paramere with subapical tooth (fig. 6b); aedeagus with two elongate spicules (fig. 6d).

DESCRIPTION: *Coloration* (fig. 1e): Head brown with red maculations on clypeus and mandibular plates. Antennae yellowish brown becoming darker distally. Prothorax yellowish brown; posterior portion of disc darker; collar undifferentiated; dorsal margin of propleuron undifferentiated, undifferentiated ventrally. Scutellum pale yellowish brown, in contrast to darker pronotum and surrounding clavus. Pleura of meso- and metathorax dark brown. Hemelytra predominately brown, anterior third deeply suffused with red; margin of clavus undifferentiated; cuneus entirely red. Abdomen dark brown throughout. Legs pre-

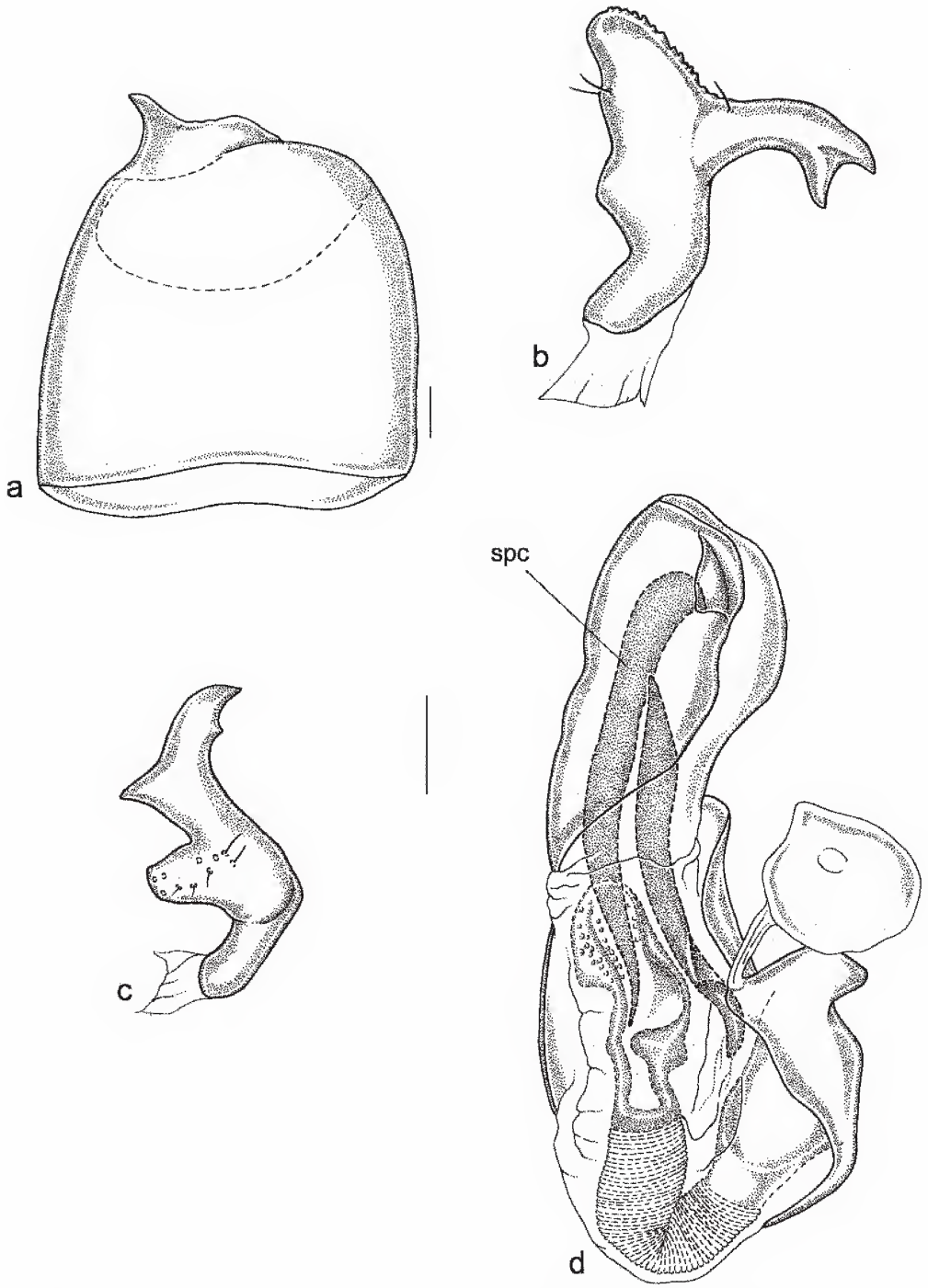

Fig. 6. Male genitalia of *Wumea cassisi*. **a.** Genital capsule, ventral view. **b.** Right paramere, lateral view. **c.** Left paramere, ventral view. **d.** Aedeagus, right lateral view (**spc** spicule; scale bars = 0.1 mm).

dominately yellow with brown tarsi, ventrally undifferentiated. *Structure*: As in generic description. *Genitalia* (fig. 6): Genital capsule barrellike with large aperture; ventral projection strongly asymmetrical, skewed to left, acute. Left paramere branched basally; basal lobe short with papillate apex; main portion of paramere hooked apically with strong tooth in hook; right paramere branched at midlength; branch recurved with weakly bifurcate apex. Theca sclerotized basally, apex with short sclerotized tooth. Aedeagus with two elongate sclerites; secondary gonopore as in generic description.

FEMALE: Unknown.

MEASUREMENTS: Males (N = 2): L-Tot 5.34–5.40, Cly-Cun 3.77–3.89, L-Hd 0.41–0.52, L-Prn 0.79–0.86, L-Sct 0.60–0.65, L-Cun 0.89–1.05, W-Hd 0.69–0.70, W-Prn 1.07–1.13, W-Sct 0.57–0.59, IOD 0.31–0.33, L-AI 0.83–0.86, L-AII 2.26–2.36, L-AIII 1.55, L-AIV 1.67, L-mtf 2.30, L-mtt 3.73.

ETYMOLOGY: Named for Gerasimos Cassis, in recognition for his efforts to support and encourage students in the study of Heteroptera.

HOSTS: Collected from *Saurauia* sp. (Actinidiaceae).

DISTRIBUTION: Northeastern New Guinea, Huon Peninsula.

PARATYPES: **PAPUA NEW GUINEA: Morobe:** Trail between Moigisung and Manga, 6.4167°S 147.5°E, 500 m, 16 Sep 1976, W. C. Gagne, *Saurauia* sp. (Actinidiaceae), 1♂ (AMNH_PBI 00053256) (BPBM).

Wumea cylpealis Carvalho
figures 1f, 7

Wumea clypealis Carvalho 1987: 187.

DIAGNOSIS: Differentiated from similar taxa by characters listed in generic diagnosis and genital capsule with broadly rounded ventral projection (fig. 7a); broadly crescent-shaped right paramere (fig. 7b); aedeagus with elongate basal sclerite and two broad lobal sclerites (fig. 7d).

REDESCRIPTION: *Coloration* (fig. 1f): Head yellowish brown with vague red maculations on clypeus and mandibular plates. Antennae yellowish brown becoming darker distally. Prothorax yellowish brown; posterior portion of disc darker; collar undifferentiated; dorsal margin of propleuron undifferentiated, undifferentiated ventrally. Scutellum pale tan, in contrast to darker pronotum and surrounding clavus. Pleura of meso- and metathorax dark brown. Hemelytra predominately reddish-brown, anterior third more deeply suffused with red; margin of clavus undifferentiated; cuneus margined with red, anterior and posterior portions with larger red maculations. Abdomen dark brown throughout. Legs predominately yellowish brown becoming brown distally, ventrally undifferentiated. *Structure*: As in generic description. *Genitalia* (fig. 7): Genital capsule subconical with large aperture; ventral projection weakly asymmetrical, slightly skewed to right, broadly rounded. Left paramere branched basally; basal lobe with papillate apex; main body of paramere hooked apically with weak teeth in hook; right paramere broadly crescent-shaped with papillate apex. Theca sclerotized basally, simple. Aedeagus with elongate basal sclerite and two broad lobal sclerites, both lobal sclerites with single medial tooth; secondary gonopore as in generic description.

FEMALE (fig. 1b): Similar to males. *Genitalia:* Ovipositor as in generic description. Vestibulum simple, saclike; sclerotized rings large, weakly sclerotized, laterally folded for entire length, over twice as long as broad, aperture irregular; dorsal labiate plate simple; posterior wall with paired interramal sclerites; interramal lobes (K-structures of Slater 1950) one-fifth the length of the ovipoister, semicircular, slightly divergent, distinctly spinulose.

MEASUREMENTS: Males (N = 5): L-Tot 4.66–5.1, Cly-Cun 3.40–3.66, L-Hd 0.37–0.53, L-Prn 0.71–0.83, L-Sct 0.50–0.56, L-Cun 0.81–0.86, W-Hd 0.69–0.74, W-Prn 1.01–1.13, W-Sct 0.52–0.55, IOD 0.25–0.33, L-AI 0.65–0.73, L-AII 2.07–2.17, L-AIII 1.33–1.44, L-AIV 1.69, L-mtf 2.26–2.33, L-mtt 3.40–3.46. Females (N = 3): L-Tot 5.03–5.07, Cly-Cun 3.38–3.84, L-Hd 0.32–0.49, L-Prn 0.74–0.81, L-Sct 0.50–0.63, L-Cun 0.81–1.01, W-Hd 0.67–0.71, W-Prn 1.04–1.08, W-Sct 0.42–0.51, IOD 0.30–0.33, L-AI 0.69–0.79, L-AII 2.06–2.12, L-AIII 1.36–1.39, L-AIV 1.70, L-mtf 2.34, L-mtt 3.46.

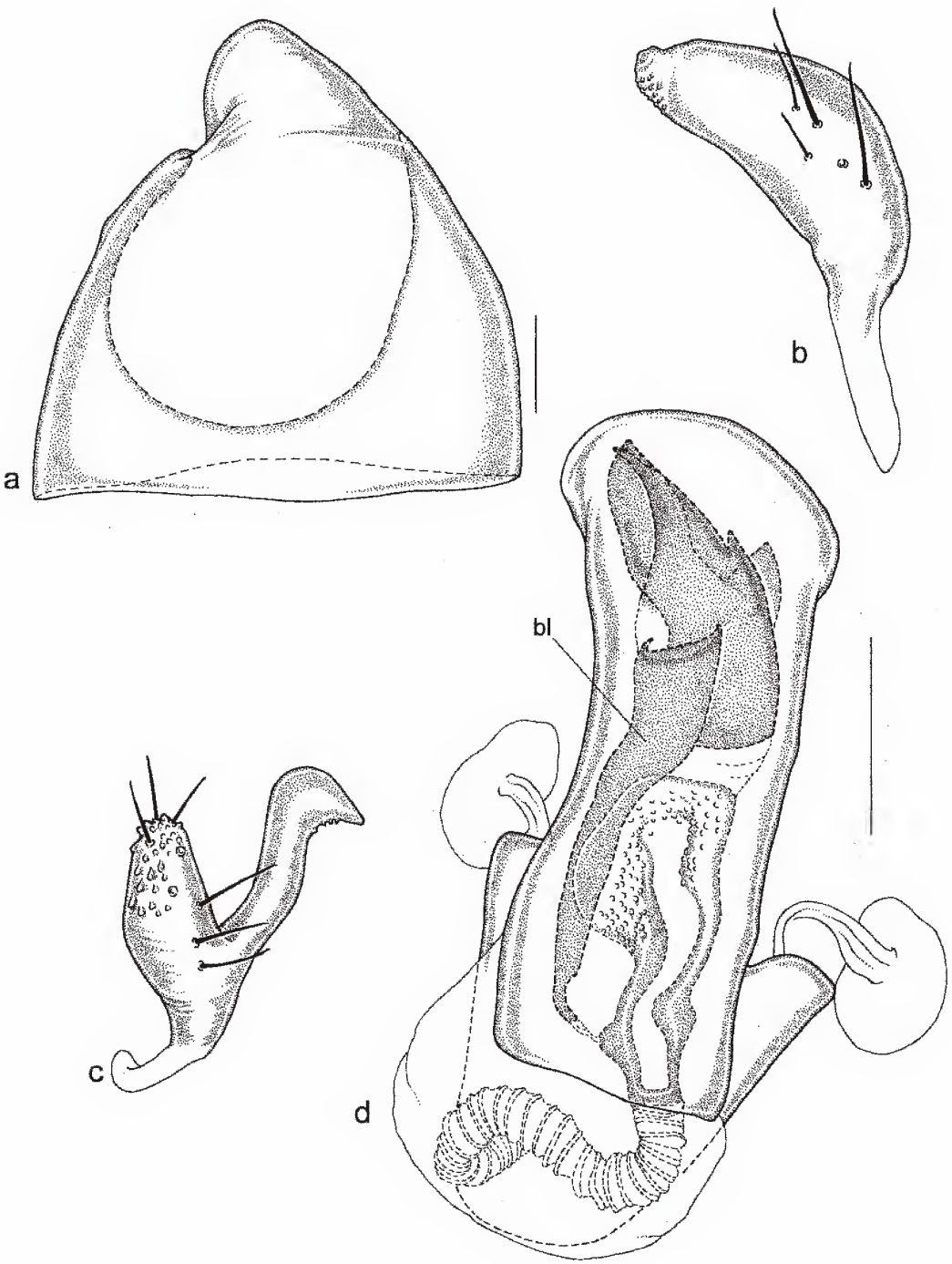

Fig. 7. Male genitalia of *Wumea cylpealis*. **a.** Genital capsule, ventral view. **b.** Right paramere, lateral view. **c.** Left paramere, ventral view. **d**. Aedeagus, ventral view (**bl** basal lobe; scale bars = 0.1 mm).

HOSTS: Unknown.

DISTRIBUTION: Central New Guinea.

SPECIMENS EXAMINED: **INDONESIA: Irian Jaya:** Swart Vale, 3.6°S 138.46667°E, 1400 m, 7 Nov 1958–18 Nov 1958, J. L. Gressitt, Paratype, 6♂ (AMNH_PBI 00053239-AMNH_PBI 00053240, AMNH_PBI 00053242-AMNH_PBI 00053245), 3♀ (AMNH_PBI 00053237-AMNH_PBI 00053238, AMNH_PBI 00053241) (BPBM).

REMARKS: The male genitalia of *Wumea cassisi* differs substantially from that of the type species of the genus. *Wumea cassisi* possesses a large barrel-shaped genital capsule, a branched right paramere, and an aedeagus with spiculi. In contrast, *W. clypealis* has a simple right paramere, a weakly flattened conical genital capsule, and an aedeagus with lobal sclerites and basal process. Despite these differences, the two taxa are remarkably similar on a superficial level and are provisionally placed in the same genus.

Sagittacopula, new genus

TYPE SPECIES: *Sagittacopula rufescens*, n.sp.

DIAGNOSIS: Recognized among other Orthotylini by the following combination of characters: elongate parallel-sided body (figs. 1g, h); strongly carinate posterior margin of head projecting over anterior margin of pronotum; pronotal collar weak, flat; disc of pronotum distinctly rugulose; posterior margin of the pronotum broadly emarginate; metathoracic legs relatively long. Males distinguishable from similar genera by conical papillate tubercle on left lateroposterior margin of male genital capsule (figs. 8, 9b); genital chamber separated from proctiger by sclerotized supragenital bridge; large curved right paramere; and aedeagus with membranous thumblike lobe extending from phallotheca (fig. 9e).

DESCRIPTION: Male: *General Aspect*: Macropterous, elongate, parallel-sided, total length 4.25–4.32; length from apex to clypeus to cuneal fracture 2.89–3.01; width across humeral angles of pronotum 0.99–1.00. *Coloration and vestiture* (figs. 1g, h): Dorsum orangish red to reddish brown; clypeus, labium and antennal segment I red; antennal segments II-IV dark brown. Hemelytral membrane moderately suffused with brown; veins red. Legs yellowish orange, distal portion of metafemora red. Dorsum sparsely adorned with fine, short, hyaline setae; metepisternum with field of dense microchaetae; legs and antennae with fine, short, hyaline setae. *Structure*: Head moderately projecting in front of eyes; posterior margin convex; posterior margin strongly carinate, projecting over anterior margin of pronotum; frons flat posteriorly becoming steeply declivent anteriorly; clypeus distinctly projecting in front of frons; gena and maxillary plates extending anteroventrally; buccal cavity obovate, posterior margin well separated from anterior margin of prosternum; eyes occupying about one-half of total head height in lateral view, posterolateral margin well separated from margin of pronotum; antennae inserted midway between ventral and dorsal margins of eye. Antennae elongate, gracile; segment I subequal to length of pronotum, vasiform; segment II cylindrical, elongate, three times longer than segment I; segment III and IV gracile, often deformed in dry specimens. Labium reaching just beyond posterior margin of metacoxae. Pronotum elongate trapeziform, slightly longer than broad, weakly rugose with very fine, sparse puncation; pronotal collar thin, shallowly emarginate dorsally; lateral margins slightly emarginate; posterior margin distinctly sinuate with medial emargination; disc weakly convex, vaguely separated into anterior and posterior lobes by shallow sulcus; calli obsolete. Mesoscutum not exposed. Scutellum triangular, slightly convex. Hemelytra elongate, parallel-sided to posterior margin of cuneus; cuneus two to three times longer than broad. Metathoracic spiracle large with evaporative areas; ostiole lenticular, placed anteriorly on metepisternum; peritreme swollen anteriorly and posteriorly; evaporative area extending to posterior margin of metepisternum, slightly swollen and deflexed posteriorly. Legs extremely elongate; claws moderately curved with apically convergent parempodia. *Genitalia* (figs. 8, 9): Genital capsule large, subconical to subcylindrical; ventral projection variable; dorsoposterior margin with large tubercle on left side; genital chamber separated from proctiger by sclerotized supragenital bridge. Left paramere bent;

angle swollen, bulbous; free arm narrowed distally. Right paramere elongate curving anterodorsally to dorsal tubercle of genital capsule. Phallotheca relatively simple, slightly sclerotized with distal toothed angular projection and membranous thumblike lobe laterally. Aedeagus relatively simple; ductus seminis heavily sclerotized prior to secondary gonopore; secondary gonopore weakly defined, surrounded by papillate membrane.

FEMALE: Similar to males. Ovipositor relatively short, one-third to one-fourth as long as abdomen; subgentital plate large, broadly triangular with rounded distal margin, approximately one-half the length of ovipositor.

ETYMOLOGY: Combination of the Latin noun *sagitta* ("arrowhead") and the Latin noun *copula* (a "clasp" or "tie that binds"), referring to the arrowlike shape of the right paramere. The gender is feminine.

REMARKS: *Sagittacopula* is interesting due to the presence of a sclerotized supragential bridge between the genital chamber and the proctiger. A sclerotized supragential bridge is widespread in the Cylapinae and Bryocorinae (Konstantinov, 2003), but is rarely noted in the Orthotylinae with the exception of *Hadronema* Uhler and related genera (Schwartz and Forero pers. comm). Potentially acting like an expanded paramere socket, the sclerotized supragential bridge in *Sagittacopula* may be necessary to support the grossly enlarged right paramere.

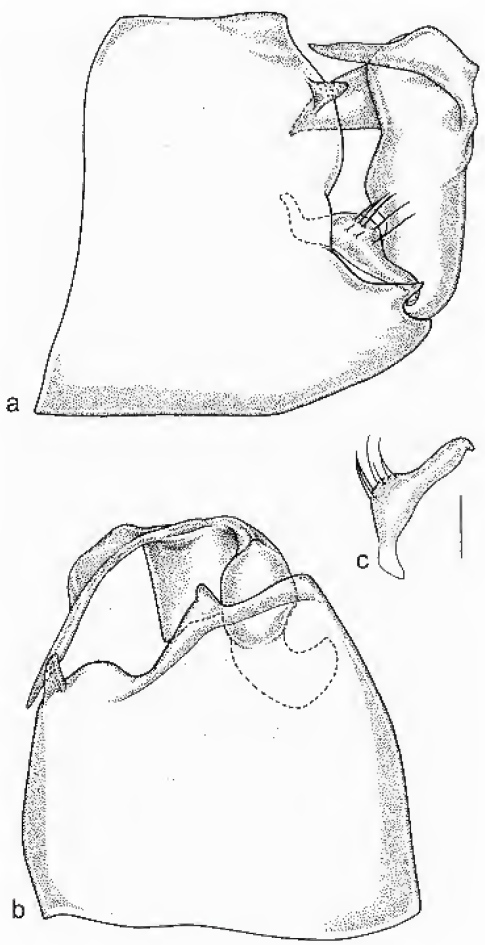

Fig. 8. Male genitalia of *Sagittacopula carvalhoi*. **a.** Genital capsule with parameres, lateral view. **b.** Genital capsule with right paramere, ventral view. **c.** Left paramere, anterior view (scale bars = 0.1 mm).

Sagittacopula carvalhoi, new species
figures 1g, 8

HOLOTYPE: **PAPUA NEW GUINEA: Morobe:** Oomsis, 6.67166°S 146.8°E, 2 Aug 2000, R. L. Kitching, 1♂ (AMNH_PBI 00053255) (AM).

DIAGNOSIS: Recognized by the characters listed in the generic diagnosis and by the brownish-red coloration; genital capsule with a small acute ventral projection (fig. 8b); and right paramere with a large triangular dorsomedial flange (fig. 8).

DESCRIPTION: Coloration, vestiture, and somatic structure (fig. 1g) as in generic description. *Genitalia* (fig. 9): Genital capsule large, subcylindrical; ventral projection small, assymetrical, acute; tubercle of dorsoposterior margin relatively small, finely papillate. Left paramere as in generic description. Right paramere with large triangular tooth at midlength. Phallotheca relatively simple, slightly sclerotized with distal angular toothed projection, elongate membranous lobe extending laterally from below toothed projection. Secondary gonopore not visible in undissected specimen.

FEMALE: Similar to males. *Genitalia*: Ovipositor as in generic description. Internal genitalia unknown due to lack of material.

MEASUREMENTS: Male (N = 1):, L-Tot 4.25, Cly-Cun 2.89, L-Hd 0.28, L-Prn 0.67, L-Sct 0.52, L-Cun 0.88, W-Hd 0.67, W-Prn

1.00, W-Sct 0.52, IOD 0.31, L-AI 0.81, L-AII 2.37, L-AIII (damaged), L-AIV (damaged), L-mtf (damaged), L-mtt (damaged). Female (N = 1), L-Tot 4.41, Cun-Clyp 3.36, L-Hd 0.37, L-Prn 0.80, L-Sct 0.52, L-Cun 0.76, W-Hd 0.72, W-Prn 1.05, W-Sct 0.53, IOD 0.31, L-AI 0.84, L-AII 2.48, L-AIII 1.45, L-AIV 2.40, L-mtf (damaged), L-mtt (damaged).

ETYMOLOGY: Named in honor of J.C.M. Carvalho for his pioneering efforts to describe the plant bug fauna of New Guinea.

HOSTS: Unknown.

DISTRIBUTION: Eastern New Guinea.

PARATYPES: **PAPUA NEW GUINEA: Morobe:** Oomsis, 6.67166°S 146.8°E, 5 Jul 2000, R. L. Kitching, 1♀ (AMNH_PBI 00053254) (AM).

Sagittacopula rufescens, new species
figures 1h, 9

HOLOTYPE: **AUSTRALIA: Queensland:** West Claudie River, 12.8333°S 143.35°E, 25 Jun 1982, M. A. Schneider and G. Daniels, 1♀ (AMNH_PBI 00053236) (UQIC).

DIAGNOSIS: Recognized by the characters listed in the generic diagnosis and by the bright orange-red coloration; genital capsule with relatively elongate, lobed, ventral projection (fig. 9a); and right paramere with subapical auriculate lateral flange and small triangular dorsomedial flange (fig. 9c).

DESCRIPTION: Coloration, vestiture, and somatic structure (fig. 1h) as in generic description. *Genitalia* (fig. 9): Genital capsule large, subconical; ventral projection roughly symmetrical narrow, projecting; tubercle of dorsoposterior margin relatively large, finely papillate. Left paramere as in generic description. Right paramere as in generic description with large triangular tooth at midlength and more distal auriculate lobe. Phallotheca relatively simple, slightly sclerotized with distal angular toothed projection, elongate membranous lobe extending laterally from below toothed projection. Aedeagus relatively simple; ductus seminis heavily sclerotized prior to secondary gonopore; secondary gonopore weakly defined, surrounded by papillate membrane.

FEMALE: Similar to males. *Genitalia*: Ovipositor as in generic description. Internal genitalia unknown due to lack of material.

MEASUREMENTS: Male (N = 1): L-Tot 4.32, Cly-Cun 3.01, L-Hd 0.38, L-Prn 0.77, L-Sct 0.39, L-Cun 0.68, W-Hd 0.66, W-Prn 0.99, W-Sct 0.49, IOD 0.32, L-AI 0.62, L-AII 2.06, L-AIII 1.14, L-AIV 1.40, L-mtf 2.11, L-mtt 3.31. Female (N = 1): L-Tot 4.74, Cly-Cun 3.28, L-Hd 0.34, L-Prn 0.7843, L-Sct 0.45, L-Cun 0.788, W-Hd 0.67, W-Prn 1.03, W-Sct 0.51, IOD 0.35, L-AI 0.76, L-AII 2.20, L-AIII 1.20, L-AIV 1.95, L-mtf 2.38, L-mtt 3.67.

ETYMOLOGY: Named for the predominately reddish coloration of this species.

HOSTS: Unknown.

DISTRIBUTION: Wet tropics of Queensland.

PARATYPES: **AUSTRALIA: Queensland:** Kuranda, 16.8167°S 145.65°E, 1 Apr 1919–30 Apr 1919, F. P. Dodd & Sons, 1♂ (AMNH_PBI 00053253) (SAMA).

DISCUSSION

To try to contextualize these species within the Pacific Orthotylinae would largely be an exercise in speculation. Unlike the Indo-Pacific Phyline, which has received contemporary synthetic study by Schuh (1984), the Orthotylinae of the area are little studied with the exception of Hawaii (Asquith 1994, Gagne 1997) and sporadic attention by Carvalho (1983, 1987). Based on the author's study of the Indo-Pacific Orthotylinae collections at the Bernice P. Bishop Museum and the Australian Museum, the genera and species described here represent a small fraction of the undescribed Indo-Pacific Orthotylinae. Much of the undescribed Indo-Pacific fauna is superficially similar in general morphology (e.g., elongate, shiny, long-legged, often with carinate posterior margin on head and flat pronotal collar), but remarkably different in the morphology of male genitalia. In the taxa described herein the complex phallotheca of *Morobea* stands in contrast to the simple phallotheca of *Wumea* and *Sagittacopula*. On the other hand, the presence of lobal sclerites and spiculi distinguish *Morobea* and *Wumea* from the simple membranous vesica of *Sagittacopula*. The external female genitalia are relatively conservative among taxa described here. The internal female genitalia are known from only two species, due of a lack of dissectible material, and can not illuminate

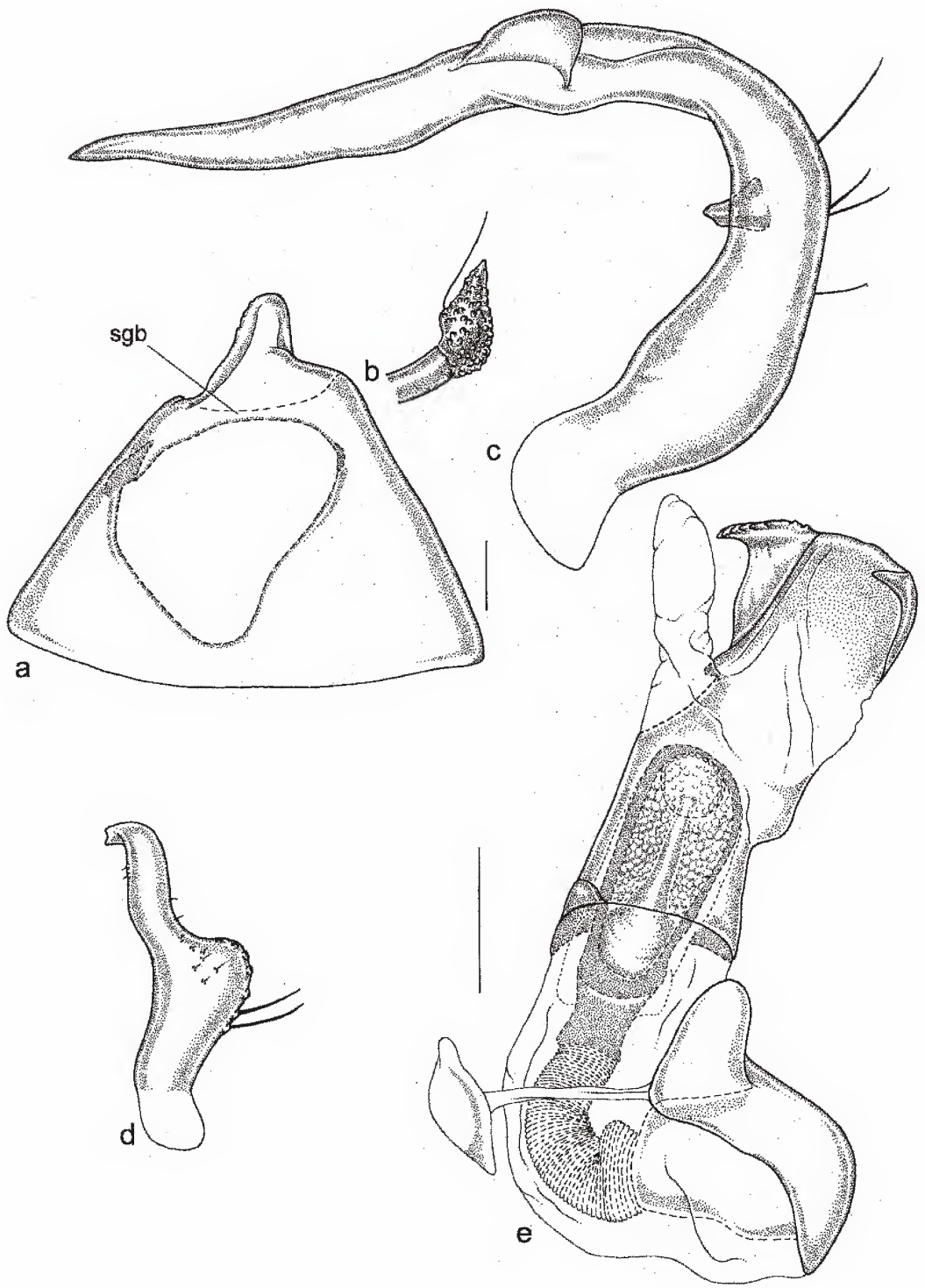

Fig. 9. Male genitalia of *Sagittacopula rufescens*. **a.** Genital capsule, ventral view. **b.** Magnified view of tubercle on genital capsule, dorsal view. **c.** Right paramere, posterior view. **d.** Left paramere, ventral view. **e.** Aedeagus, dorsal view (**sgb** supragenital bridge; scale bars = 0.1 mm).

relationships without greater sampling. Due to the diversity in the male genitalia and the potential for convergence in somatic characters, these taxa are not considered by the author to represent a monophyletic lineage. However, the relationship of these genera to each other, as well as to other orthotylines, must await a more comprehensive study of the Indo-Pacific Orthotylinae.

ACKNOWLEDGMENTS

Sincere appreciation is extended to Hannah Finlay for illustrating the male genitalia and preparing the plates in this publication. This project was supported by and represents a contribution to NSF Planetary Biodiversity Inventory grant DEB-0316495 to Randall Schuh and Gerasimos Cassis. The manuscript was improved by the comments of two anonymous reviewers. Several individuals and institutions provided material for this study. Particular thanks are extended to Alistair Ramsdale (Bernice P. Bishop Museum), who has been extremely helpful in facilitating the particularly large loans necessary for the Planetary Biodiversity Inventory. Institutional abbreviations and responsible curators/collection managers are presented in the following list: Australian Museum, Sydney, Australia, Geasimos Cassis (AM); Bernice P. Bishop Museum, Honolulu, Alistair Ramsdale (BPBM); South Australian Museum, Adelaide, Australia, Jan Forrest (SAMA); Department of Entomology, Queensland University, Brisbane, Australia, Greg Daniels (EUQ).

REFERENCES

Asquith, A. 1994A. Revision of the endemic Hawaiian genus *Sarona* Kirkaldy (Heteroptera: Miridae: Orthotylinae). Bishop Museum Occasional Papers 40: 1–81.

Carvalho, J.C.M. 1983. A new genus and four new species of Miridae from Oceania (Hemiptera). Revista Brasileira de Biologia 43: 401–409.

Carvalho, J.C.M. 1987. New genera and new species of Miridae from Papua New Guinea (Hemiptera). Revista Brasileira de Biologia 47: 177–187.

Gagne, W.C. 1997. Insular evolution, speciation, and revision of the Hawaiian genus *Nesiomiris* (Hemiptera: Miridae). Bishop Museum Bulletins in Entomology 7: 1–226.

Kerzhner, I.M., and R.T. Schuh. 1995. Homonymy, synonymy, and new combinations in the Miridae (Heteroptera). American Museum Novitates 3137: 1–11.

Konstantinov, F.V. 2003. Male genitalia in Miridae (Heteroptera) and their significance for suprageneric classification of the family. Part I: general review, Isometopinae and Psallopinae. Belgian Journal of Entomology 5: 3–36.

Schuh, R.T. 1984. A revision of the Phylinae (Hemiptera, Miridae) of the Indo-Pacific. Bulletin of the American Museum of Natural History 177: 1–476.

Schuh, R.T. 1995. Plant bugs of the world (Insecta: Heteroptera: Miridae). Systematic catalog, distributions, host list, and bibliography. New York: New York Entomological Society, 1329 pp.

Slater, J.A. 1950. An investigation of the female genitalia as taxonomic characters in the Miridae (Hemiptera). Iowa State College Journal of Science 25: 1–81.

Complete lists of all issues of the *Novitates* and the *Bulletin* are available at World Wide Web site http://library.amnh.org/pubs. Inquire about ordering printed copies via e-mail from scipubs@amnh.org or via standard mail from: American Museum of Natural History, Library—Scientific Publications, Central Park West at 79th St., New York, NY 10024. TEL: (212) 769-5545. FAX: (212) 769-5009.

This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).